

# **SIDEWALL BLOWING TIPS AND TRICKS**

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Home Performance with ENERGY STAR®

Jim Fitzgerald additions included.

## **DO IT ONCE - DO IT RIGHT!**

High-density sidewall cavity insulation can be a major comfort and savings boost. It saves energy by slowing both conductive and convective losses, but only if the right things are done and done right. This always requires site-specific thinking.

## **MEET EACH BUILDING'S SPECIAL NEEDS**

Every building is unique. The building and thermal envelopes, HVAC systems and the people that live there all interact.

To do the right things with sidewall insulation one must:

Understand what the client needs and knows about their house.

Evaluate initial air leakage, R-values, and structural characteristics. What is the dominant framing style? Be sure the building shell is weather tight.

Document any conditions needing repair before work like roof and plumbing leaks; check CO on all combustion appliances and perform worst case spill test. Is upgrade to sealed combustion needed?

Define the thermal envelope. Work to make sure framing connections are airtight between building sections. Consider the issues of temperature and space conditioning. Understand how porches and building additions connect.

Plan access, timing, production, and job-site strategies. Think of options if the weather gets bad, or obstacles arise. Discuss the possibility of drilling from inside with the clients.

Prioritize the energy conservation work to be done. Think about savings estimates compared to actual energy usage. Estimate CFM50 reduction and worst-case depressurization after work.

Forecast the need for mechanical ventilation. Is this house a good candidate?

Get the job done.

Recheck air leakage; continue air sealing to reach desired closure.

If below tightness limit for size or occupancy, order mechanical ventilation to bring up to ASHRAE recommendations.

Check natural and induced draft appliances for backdrafting. Order repairs necessary to eliminate backdrafting.

Leave the site clean and the client happy.

**Inspect the interior for places where insulation might blow into the house -- gross holes in the plaster, loose paneling, back plastered walls, pocket doors, missing wall sections under sinks, stairwells, etc.**

**Note the location of major wall air leakage sites, i.e. the ceiling-joint connection at the porch roof,**

**flat roof connections, plumbing chaseways on an outside wall, slanted roof cavities crossing joist volumes, and any place the air barrier can't be inspected and may be discontinuous.**

Wall insulation must give continuity to the thermal envelope and be of a consistently high density to limit hidden air leaks and bypasses. This often uses about 30% more material than just filling.

When insulating walls, one never knows what the framing details will be. Open cavities, firestops, bracing, blockers, interconnected chases and unexpected air leak paths are common.

## **AIR SEAL COST EFFECTIVELY**

Set and track airsealing targets. Follow recommended procedures for diagnosing air leakage and determining minimum ventilation rates for your area. See current and updated ASHRAE 62 recommendations.

- Always seal major bypasses before insulating the attic. Insulate sidewalls from attic when practical.
- Insulate sidewalls and test air leakage and combustion spillage before doing minor air leakage work.
  - Provide mechanical ventilation if leakage below ASHRAE recommendations
  - Perform worst-case spillage test and repairs needed after all tightening and fan changes.

## **ACTIVELY CONTROL QUALITY**

Insulation jobs often fail due to gross air leaks. The results can be reduced savings, uncomfortable people, frozen pipes, condensation, mold, mildew, frost, ice, or other moisture problems... and an angry call back to the job.

It costs time and money to go back to a job for any reason. It pays dividends for everyone involved to be an active quality controller.

## **QUALITY CONTROL SUMMARY**

- **Probe 100% of the cavities as a part of blowing.**
- **Don't leave any wall or attic voids or bypasses**
- **No guessing means no voids!**

## **LEAVE A SAFE HOME, CLEAN SITE, AND HAPPY OCCUPANT**

- Identify existing safety hazards.
- Double check your work.
- Don't create new problems.
- Leave the house in as good or better condition than you found it.

## **SIDEWALL INSULATION PROCESS**

For filling most walls, we prefer the one hole tube method to the two-hole reducer method. This is how it goes on a "typical" job site:

## **FIRST THINGS FIRST: INSPECT AND EVALUATE THE HOUSE.**

Perform a lead test on any painted surface to be drilled - do not drill if positive for lead without lead

safe practices in place. Without a lead test, do not consider interior blowing.

Check for unventilated space heaters and furnace, water heater safety problems. Don't start work until CO and spillage issues fixed. Stop if there is a hazard.

Take a pre-test blower door reading at 50 Pa to get the air changes per hour flow. Run the test with all inside and basement doors open and all exterior doors shut.

Ask the homeowner about the cost to heat or cool the house and if any special problems exist such as ice dams, drafts, pipes freezing, cold rooms, condensation, or roof leaks.

Inspect the interior for places where insulation might blow into the house -- gross holes in the plaster, loose paneling, back-plaster walls, pocket doors, missing wall sections under sinks and stairwells, 3/8 plasterboard, acoustical tile, other interior finishes that won't support blowing, etc.

Check for active knob-in tube wiring. Contact licensed electrician to replace or maintain clearance in conformance with NEC recommendations. Circuit load /voltage drop test recommended if insulation allowed with existing knob-in tube. NEC recommends not more than 5% voltage drop under load. Test before and after insulation.

Make a note of the location of recessed lights near walls, electrical fixtures, outlets, hot air ducts, cold air returns and plumbing in exterior walls.

Maintain clearance from contact with soil or possible plumbing or flashing leaks. Block with fiberglass batt or foam board for capillary break from all moisture sources.

Note the location of major wall air leakage sites, i.e. the ceiling-joint connection at the porch roof, flat roof connections, plumbing chaseways on an outside wall, slanted roof cavities crossing joist volumes, and any place the air barrier can't be inspected and may be discontinuous.

## **NEVER ASSUME THE FOLLOWING:**

All walls are strong enough to dense pack, or even blow

Heat ducts are all closed, and not connected or open to wall cavities

The wall in the walk-in closet behind 6' of knick-knacks and collectibles is really in good shape and it doesn't need checking

Blowing insulation in the same hole for 5 minutes is a good sign

The original plaster ceiling above a dropped ceiling is in good shape

## **LIVING SPACE**

Follow the entire perimeter, check under sinks, behind cabinets, drawers, stoves, boxes, etc. Do not assume the picture on the wall is not hiding a 2" hole!

Ductwork. Unless you can tell from the basement, remove diffusers and verify

Pocket doors

Weak walls

Thin walls

Recessed shelving, lighting, soap and toilet paper holders

Outlets, receptacles, wiring runs

Plumbing lines

Plenums, framing irregularities, bulkheads

## **BASEMENT:**

Perimeter, for open stud cavities, missing bottom plate, open bays,

Chaseways into attic; soil stack, chimney, partition walls, esp. at junctions, additions, bearing walls

Under the bathtub, plumbing access- this is a biggie. Learn how to blow this cavity to keep the bath water hotter longer. Pack behind fiberglass batt used as a dam to keep supply and drain piping clear.

## **STRATEGIZE, SET UP, AND GET GOING**

- The production goal is to start insulating within 1/2 hour of arriving.
- Chose which pieces of siding must be removed for the quickest production, i.e. fastest access to the most full height wall cavities. These are often low on the house since it is easier to drill the holes nearer the floor and insert the tube up the wall. It minimizes ladder work and hassles with the tube. Each house, however, is different.
- As the first siding is coming off, (see section on Siding Removal) someone should be establishing adequate electric power, getting drills ready, setting up the blower, and running hoses, cords and remote switches. (see Blower Basics)

## **DRILL HOLES AND PROBE 100%**

- After the first siding is removed, drill through the sheathing with a low speed 1/2" drill (400-600 rpm) using a 2-1/4" self feed bit or equivalent. The Timber wolf angle drill with a clutch provides safety and a relief to sore hands.
- Angle the hole up in the direction the tube has to go. This allows easier insertion of the tube. If the hole is in the middle of the cavity, angle up and down.
- It is the drill person's job to open holes and find all blockers, both side-to-side in the wall and close to the hole. Use a wire or measuring tape to probe each hole.
- The hoser's job is to use the tube to find all blockers up and down and call for additional openings as needed.
- Together, they probe 100% of the house surface. Sometimes, the driller may leave easy holes so the tube person has something to do while waiting for the cavity to fill.
- As the hoser is getting into production on the big areas first opened, the driller proceeds to open the detail areas around windows, dormers, and hidden bypasses.

## **TUBING BASICS**

Obtain 10' of 1-1/4" ID clear vinyl tube with 1/8" wall thickness and a 2" x 1-1/4" reducer.

Straighten the tube with a heat gun and cut a 45-degree bevel off the tip to steer off obstacles. (J&R Products 800-343-4446 supplies both summer and winter grades) attach the reducer to the 2" blowing hose. Local plastics suppliers may have water suction hose, which is acceptable as well. Avoid plumbing PVC and ABS due to static electricity buildup and discharge.

Always blow air first to establish free flow through the hose; whenever there is a clog or other problem, stop feeding material but keep the air on to blow the hose clear.

Start in a normal 2x4 8' tall wall without a lot of windows or busy details. Push the tube all the way into the cavity until you actually feel the blocker at the end. Verify that you have 8' of tube into the 8' cavity.

If the hole is in the middle of the wall, push the tube up first, pack the wall and then down to get complete coverage.

Turn on the blower. First blow air then air plus feed. No matter which type you use, cellulose should be moving fast, crackling through the tube.

Start with the air gate wide open and adjust until you are packing an 8' cavity tightly in 2-4 minutes. While the cavity is packing, there is time for the operator to drill 3 or 4 more holes nearby or to start a second cellulose-only blower.

If you are using a small, cellulose-only blower, there is only one switch. Pull the hose out 1' at a time as the material packs up and stops flowing. Typically more air is needed if the flow is too fast and soft or less air is needed if the trickle of feed needs to be increased. Don't dawdle with the material stopped. The faster machines may need a pull back of 2' to get velocity back up. If the velocity stays high the pack tends to be more uniform. When the hose bogs down for a long time, soft areas may be left in the cavity. Open the air gate a bit more and re-blow after a sluggish section.

Airlock machines with fan-type blowers can start with the air adjustment set back to 50 or 60 inches of water or 2psi and the feed gate open about 25% 5 or 6 holes for the force 2 or 4" for the Krendl. Positive displacement blowers also need an rpm control on the gas or diesel engine to manage the air volume. Start the positive displacement blowers at 40-50 inches of water with the bleed valve open and extra weights off the cap. Increase adjustment of feed and air to get 4# density in about 90 seconds to 2 minutes per cavity or about 12 bags per hour. Faster feeding provides fewer wall problems with less total cfm of air being forced through a cavity. The second blower on a double blower machine can be added in at 40-60" plus more material to increase fill speed if the operator can manage the flow. If you are blowing floors or other larger cavities with good air release, full air operation at 120 inches and above is safe with a faster feed rate. Always use the biggest diameter hose that allows workable access.

The highest skilled person on the crew should be drilling the holes with the old-style cellulose only machine. The airlock machine requires skill at both positions.

When using an airlock blower, the air and feed need to run independently. As the cavity packs tight, the feeder continues to supply material at the same rate, even though much less material leaves the tube. This lowers density in the wall and clogs the hose. Therefore, as the cavity fills and the wall starts to pack tight, switch off the feeder and allow the air to run. This prevents clogs in the hose as you finish the stud run.

Open the feed gate in small increments when adjusting to pack the 8' cavity 90 sec to 2 minutes. For 2x6 cavities and faster production increase hose diameter and feed settings and upgrade to a double blower machine. 1-1/2" 1/8" wall clear suction hose or 1-1/2" poly braid vinyl will blow 15-18 bags per hour where production with 1-1/4" is more typically 8-10 bags per hour. For larger cavities like floored attics use 2" to 2-1/2" diameter tube or regular blowing hose. Remember, avoid plumbing PVC and ABS due to static electricity.

## **PRODUCTION AND DENSITY**

- Learn to time your fill based on your equipment. Start with three 8' cavities, 16" o.c., and one 30 pound bag of cellulose. If you're blowing right, a 30 pound bag should run out just before you're done with the third run. With normal 3-1/2 to 3-5/8" thick framing, 3- 2x4x8' cavities should use 30-36# of material or 15 8' cavities should consume approximately 6-30# bags.

- If the cavity isn't filling up after 4 minutes, shut down and go inside to see where it's going. Never run over 4 minutes without a look. Either you're filling up a part of the house or, hopefully, a hidden bypass.
- Check the density often. The holes should be packed so tight that your finger can't poke into it. As you go, you may feel air coming out of the empty hole of the next cavity but you should not feel air exhausting from a cavity that has already been filled.
- Redo any cavity that's not tight enough.
- Settling of insulation is not an issue at 3.5 to 4 lb/cu ft density; blowing off the wall is. The higher air pressure required to pack insulation tight enough to stop air leaks is sometimes too much for funky wall plaster and paneling.
- Disastrous as it seems, it is bound to happen and it does teach vigilance. Most important is to learn effective damage control: don't continue to fill the entire room; have adequate tools and supplies to make repairs. Cleaning and patching are unfortunate facts of life with wall filling, but they need not be a part of many jobs.

## PROPER DENSITY

If you add excess air to reach target densities without air relief from the cavity, you run the risk of blowing out many walls. Note: In very tight walls, material can stop flowing into the cavity due to lack of air release, blow these from the top of the cavity, or add air release holes. The risk of damage goes up and the extra benefit from tightening goes down in walls with no leakage.

It is crucial to assure your machine is achieving proper density, which is 3.5-to 4 pounds of material per cubic foot. Less than 3.5 lbs/ft<sup>3</sup> will allow settling and too much air movement in the cavity. Note: if you are blowing between smooth surfaces such as poly and OSB, some settling is likely below 4# density. (Unusual extra heights with wider cavities such as 14' tall 12" superinsulation cavities with smooth sides have shown settling over time and are beyond the scope of this guide.)

The best way to check it is to weigh a sample of a known volume. Core samples work well. One sq. ft. in a 2x4 wall should weigh from 1 to 1.3 pounds. Otherwise find a wall section of known volume with no odd soffits or open floor joists attached (height x width x depth – framing, plates, etc.) and calculate the amount of insulation that will fill the cavities. For example each 8' cavity should use 10-12 pounds of material as a minimum to reach the desired 3.5 to 4# density. With 4" thick walls the range is 11-13 pounds per cavity. One 30# bag should run out before 3 cavities are packed. Bag weights do vary somewhat. Use 4.0#/ft<sup>3</sup> for the target density. A core sampler can be made or purchased if more precise density checks are desired, see attachment. Check material consumption after the first 3 cavities and adjust the machine accordingly. Experienced installers know their machines, but conditions including set-up, equipment age and even weather can cause insulation to be blown at either higher or lower densities than expected. Since some joist openings and enclosed soffit details are embedded in most walls the material consumption will go up a bit if these are also packed properly. Our average over many houses was 1 # per sq ft of gross area, without adjusting for framing, windows or door openings.

Weaker wall construction like 3/8" plasterboard will not allow high density. Blow to pack and use extra caulking and foam for airsealing. Don't attempt to densepack behind acoustical tile or similar soft materials.

Larger, newer machines with double blowers have an easier time reaching target densities. Smooth interior hose wall surfaces facilitate greater densities, existing wall insulation, especially fiberglass, hinder good packing. Older, weaker Force 2 blowing machines have a tendency to under-blow, which

results in significantly slower production. Replace blower motor with 3-stage, renew seals, use 10 ga. extension cords, and increase capacity of generator to 8000 watts or greater to recover productivity.

## **WHEN IS IT DENSE ENOUGH?**

- When you can't poke a finger into it.
- When you use 1 pound of insulation per square foot of gross wall area.
- When you use 3.5 - 4 lbs. / cubic foot of wall cavity.
- When you use more than 1 bag (30 lbs) for three 8' 2x4 wall cavities.
- When it takes 2-4 minutes to blow an 8' 2x4 wall cavity.
- Right before you blow the wall off! Insist on Complete Coverage

## **HIDDEN AREAS-WEIRD INTERSECTIONS**

- Any hidden areas that have not been probed by the tube must be opened and examined. This may require getting access to closed kneewall areas, adding roof vents, removing ceiling boards on porches, dropping soffit panels, lifting fascia, removing shingles, drilling interior holes where siding can't be removed, or lifting stair treads.
- After finding a bypass, the driller chooses the best access point and decides how to block off this one-of-a-kind construction detail.
- The appropriate fix may require using urethane foam, a cardboard vent chute, tin flashing, polybag, and/or blowing the cavity tight with insulation.
- Attic bypasses are also sealed at this time. Any bypass that can should be sealed with a positive surface; anything else should be blown full. Note: maintain insulation clearance from heat sources such as recessed lights and combustion venting systems. Best to provide a capillary break or barrier between plumbing and cellulose. A piece of fiberglass behind the pipes under a tub will maintain access to the supply and drain plumbing and allow the under tub volume to be packed without hiding future leaks.

## **CLOSING UP - CLEANING UP**

- Before the siding goes back up, put a small piece of fiberglass into each hole to prevent wicking of moisture from outside, replace any tarpaper removed. Plugs are acceptable but not necessary.
- Siding can sometimes be reinstalled while waiting for cavities to fill.
- Clean up the job site, both inside and out. This may mean vacuuming the lawn if there have been cellulose blowouts with the hose.
- After this stage is complete and before the crew leaves, check the work, ideally with a blower door and IR scanner. Any faults should be corrected at this point.

## **RETEST AIR LEAKAGE AND DO SAFETY CHECK**

- Take a final reading with the blower door.
- Check for negative pressures induced by exhaust fans and/or the HVAC system, which can lead to spillage and backdrafting of combustion appliances.
- Pressure balance ducts and house.
- Let the homeowner know how well you've done and see if they have any requests or complaints.

## **RETURN ON INVESTMENT**

Obviously, you will not see the leakage reductions if the opportunities do not exist in the house. If the cavity isn't leaking, it won't tighten with filling.

Very tight construction, like new airtight dry wall assemblies, doesn't release air and voids can occur when backpressure prevents the flow of material. In tight, new construction, other methods of installing cellulose have been developed. Contact U.S. Green fiber Engineered For Life, talk to Boudin at 404-496-5204 for additional information. Otherwise fiberglass batting is the preferred material.

High density blowing has the greatest impact on leakier houses. Those that show the greatest economic return are those that have a pre-weatherization blower door reading (in cfm at 50 Pa) that is greater than the above-ground surface area of the house in square feet.

## **IN CONCLUSION**

Cavity fill insulation can reduce air infiltration. However, reductions will not be realized if a leaky cavity is filled with low-density insulation or if voids are left behind. In fact, there are reports of increased air change rates after some wall insulation jobs, perhaps due to the holes drilled.

To get good results, one must do a quality job. By using cavity fill insulation to control air leakage, not only do additional savings accrue through air tightening, but one can also be more confident that the insulation R-value promised by the manufacturer is being provided to the house.

## **INSULATION BLOWER BASICS**

Having blowers in good working order, and using them right is critical to the success of the project. Whichever type you use, the remote control and communication system should be worked out. Pre-set signals to indicate trouble, less air, more feed, etc. can save job time and reduce hassles. There are two basic types of blowers used by weatherization crews.

One is the older, through the fan, cellulose-only blower. These units have agitators in the hopper which break the cellulose into pieces small enough to be pushed through the fan and hose. They need external power (electricity) and are not as powerful as later models, but can get the job done. On old-style cellulose-only blowers, start with the air gate wide open.

The second type are the more powerful positive displacement air-lock, all-fiber blowers. These units run on electricity, or are mounted on a truck and are self-powered by an integral gas motor. Because they are more powerful they can be used to blow cellulose, fiberglass, or rock wool.

For these units, start with the insulation feed gate totally closed and set the air to a level where it won't blow off the wall (you too will learn this by trial and error). Add a switch to the feeder if the blower can't be run in the "air only" mode.

## **FORCE II BLOWERS**

If using a Force-2, the machine should be maintained to provide 3.2psi or 80 in. wg at full air pressure.

The Force-2 blower motor can be upgraded to a 3-stage blower capable of 4psi. or over 120" in.wg. *Separate paper on this.*

All hoses and connections should be 100% airtight. It is a mess to have a leaking hose open up unexpectedly.

Use double-hose clamps on all connections, trim off "tails" from the clamps. These just catch on things. Use a drill to fasten and remove clamps, it is much quicker than duct tape.

Connections should be metal, and tapered when changing hose diameter. Change hose diameter in gradual increments. This will reduce plugging and contribute to smooth flow of product.

Use as little hose as necessary to do the job, especially the 1-inch wall tube. There is more friction the smaller the diameter, so this reduces speed and density. You never want to use less than 50' hose however. The wall tube must be able to reach the top plate when you are at that portion of the wall, since this doubles as a probe for hidden blockage.

I like to use 2" diameter hose after first 50' of 3". It gets stepped down with a short (10') piece of 2 1/2" hose. The 2' hose is light, and easy to work from a ladder. I don't use a shut-off valve, I just crimp the end of the wall tube upon completion of filling a hole, or stuff my finger over the opening- a bit messy but very quick transition from one hole to the next.

Keep the hopper as full as possible; the weight of insulation will cause it to feed faster. Overheating and circuit breaker operation on the agitator side indicate a weak generator or long extension cord is reducing the power for the agitator motor. Fix it rather than limp along 1/3 full.

## **ACCESS TO WALL CAVITIES & SIDING REMOVAL**

### **ACCESS TO CAVITIES**

The rule of thumb on all new jobs is to start on a wall surface where visibility is not an issue- such as the back yard or between houses. If you have to have a learning curve on this, don't let every passing car see it or let the owner be reminded every time he looks at the house. Pull a row that runs below the windows if accessibility is not an issue. You will have to tube down as well as up if you drill more than one foot above the bottom plate, so drill your holes accordingly. The idea of using the tube method is to target the end of the tube to deliver insulation at the same pressure along the entire run of the wall cavity. This provides even distribution and density. It also allows a great deal of freedom regarding the removal of siding. It essentially allows for entry into the wall at any point. Thus issues like accessibility, obstructions, plantings, building components, and number of rows to pull can be dealt with. A two-story balloon-framed house can be blown with one set of holes (except for above and below windows) for instance, if you so choose. There are some exceptions to this rule, namely the existence of the open floor joist cavities between the first and second floor in balloon framing. If a hole is drilled to close to this space the tube cannot be bent to travel up or down the wall, it ends-up between the floors, doing nobody any good. Understanding framing, one knows this is true for the ends of the joist run of the house, the other half being closed off by the floor joist. This open floor (band) joist cavity between floors must be filled- dense-packed solid, as it is a major contributor to air-loss. There will be significant amounts of cellulose blown into this cavity, which can be 6-10" deep. It is not unusual to see this blown solid 3-4' into the interior. We generally do not try to stop this flow, but minimize it by blowing into the wall cavity above the joist connection first. A 10' tube makes this step easier. Joist connections are one of the most important areas to do tightly. Less material is lost to this effect at the higher feed rates.

There are times when you don't want to fill this cavity, one good reason being unusually deep floor joists- 12-14", as in older commercial buildings. A large hole can be drilled at the band joist and a feed, onion, or other tight-weave sack inserted over the tube, into the cavity. Hold onto the end of the sack as it fills and expands into the cavity. It must be big enough to completely fill the space and create a solid "plug". Once the bag is solidly in place, stuff the ends into the hole. You can then blow up and down from there. An over-sized hole is usually drilled here to facilitate guiding the hose up and down the walls. This sack method is also particularly good for dense-packing open exposed

floor joists in attics, open partition walls, etc. 2-part foam and barriers are faster and tighter where access permits.

## SIDING REMOVAL

In the private sector, if a contractor cuts, drills or breaks any siding, they have to replace it with new. This is a description of how to remove and reinstall siding without breakage. There is no substitute for thorough hands-on training and experience.

## WOOD LAP SIDING

### Tools needed

Sawzall or small skil-saw	nail punch
Ram style nail puller	hacksaw blade
Flat bar with a smooth taper on both ends	hammer

Wood lap siding can be difficult to remove and replace without damage, especially if it is painted well, and in good condition. Pieces can be very long and brittle, full of paint, blind nailed, already starting to split, and when you are on a ladder working the second floor. It is tedious to remove a 12' section, when sometimes all you need to do is drill two cavities above a window.

To start removing cedar clapboard siding that has painted well, take a skil-saw or sawzall and cut the board to be removed at the junction with the outside corner board. Extend the cut into the next board up to cut the portion that is lapped underneath. (insert photo) Shorter pieces and tight areas may need both ends trimmed in this manner. Use ram-style nail puller to extract nails from the piece to be removed and the one above it if the nails are hard to remove. Older houses in the SW portion of the state are framed with hardwoods. The puller I use takes a bite out of the wood, but it does far less damage to the wood. If the paint is intact, there will be some chipping, but this is normal. Use the flat bar to remove the nails if they come out east without splitting the siding. Sometimes this piece will be blind-nailed, so watch for that.

When siding is particularly brittle or in compromised shape there are alternatives- remove as needed and replace with new, or pull the bottom edge slightly outward, insert a long sawzall blade behind the two rows of nails and carefully cut them off, keeping the tip pointed back. The danger here is hitting the tip of the blade on the sheathing and busting the blade, but it can be done.

Use the nail punch to drive nails in that can't be pulled.

Replace siding by lining up to original location. Nail close to, but not directly in existing holes which should be on a stud. Use galvanized nails and fill with spackling. Prime and paint as required.

Select long horizontal sections to remove. Choose boards at a comfortable height to work and where you expect to find clear access to the most wall cavities. A utility knife and/or wide-blade, sharpened, rigid spackle knife may be useful to cut existing paint beads.

Carefully pry up bottom of siding slightly. Use at least two prybars. Use a thin edge prybar or sharpen yours to slide between laps and lift out nails. Start at the center to avoid binding the ends and lift out entire siding strip evenly. Press down again on siding board and identify any additional nails. If a nail doesn't "pop", jamb its shank with a prybar while you drive the board back down. Remove the nails from two courses of siding with pliers, or prybar, using wooden shim to distribute pressure from the prying.

Particularly stubborn nails can be cut with a reciprocating bayonet saw with a long bi-metal metal

cutting blade, though this is likely to mar the siding. Use a thin piece of cardboard between the saw and the siding to reduce scarring.

Slide out the lower siding panel and drill through sheathing. Leave siding on ground right where it was removed or tack it to the house to avoid later confusion.

Replace siding with new nails, slightly offset from original, but still hitting studs. Renail with galvanized or aluminum 6d-7d box nails. Do not nail through the top of clapboards beneath the one you are installing. Replace any broken pieces with primed, new siding. Set nails and fill all nail holes. Caulk joint to corner trim and where boards butt. [An alternate but less satisfactory method is to drill directly through wood siding with two-inch drill, drilling near thicker portion of siding. Plug with two-inch tapered redwood or cedar plugs (available from insulation or blower manufacturer, being sure grain is running horizontally (or parallel to siding grain). Seal seam between plug and siding with siliconized acrylic caulk. Beat down flush using rubber mallet and a flat piece of wood. Shave plug flush with a sharp slick (large chisel), and smear a thin coat of caulk over plug to act as sealer/primer. Exposed plastic plugs are not recommended for any siding type.]

## **WOOD SHAKES OR SHINGLES**

For wood shakes and shingles, score the paint vertically on each shake to be removed.

Pry loose with a prybar and pull down.

Only take off the shake over a drill hole.

Replace by tapping up and face nail with shake nails or 4d galvanized box nails.

## **ALUMINUM SIDING**

Carefully bend out J-channel at corner of wall for the section of siding to be removed or, if it has continuous rigid corner posts, a seam. Use a "zip" tool, available from siding distributors to pry out bottom of siding above the one you want to remove so as to free the top lip of the lower sheet. A 4' piece of clothesline with a knot at one end can be pulled along inside the lock seam to open the siding without bending. Older oxidized aluminum siding is more difficult because the oxidation locks the pieces together.

Bend up upper panel gently, being careful not to crease sections. Support the upper siding piece with scraps of wood to provide you with working room. Remove the nails from the top of the siding to be removed, push it down; the J-lock should open, and the siding will come off. Be careful not to bend the siding and tack it on the wall right there to protect it.

When reinstalling siding, snap it back on the bottom and put nails through the same nail holes to align the siding to where it was before. Use the zip tool to rehook the J-lock. Press down on upper sheet and catch over lower lip and snap into place with gentle persuasion with a rubber hammer and a flat piece of wood to even up the bottom of the J as needed. Felt or other soft cloth glued to the surface of these flattening boards will reduce marring of surfaces. Ivory soap on the edges helps slip oxidized surfaces back together.

[Alternate method: Use a miniature (3-inch) fine-toothed circular saw to cut off the siding just below the bottom of the upper sheet. A piece of plastic trim, as is used with bathroom paneling, makes for an easy cover-up.] Do not use this method without prior homeowner approval. In some programs and with higher end customers, any cut or damaged siding must be replaced with new matching siding. Liability for future water entry at the new cut is a concern.

## **VINYL SIDING**

Vinyl siding is the easiest to remove –unless it is extremely cold out in which case the siding could be brittle.

Many houses have been re-sided without regards to wall insulation. The ¼” or ½” fan or foam board is for stiffness and sales; it is about the same insulation value as the air film it replaces. This is no substitute for full cavity insulation

Generally follow guidelines for aluminum siding, realizing that the vinyl is more resilient than aluminum and is unlikely to stay in a bent position. You are likely to need more shims and braces to hold bent sections in place. You are less likely to mar vinyl surfaces. The material may become brittle in frigid weather, so removal of vinyl siding should be postponed to warmer periods.

Normally vinyl siding is easily opened and closed up using the "zip" tool.

## **STEEL SIDING**

This is most difficult of the wood-siding look-alikes. The approach is similar to aluminum siding. Steel siding is more rigid and hence is more likely to crease and surface paint enamel may crack.

## **CEMENT ASBESTOS SLATES**

Some jurisdictions interpret this siding as a hazard that must be handled under limited containment by trained and certified asbestos mitigation contractors. Find out before you start.

Never drill or cut asbestos slates with a circular or reciprocating saw. Wear high-quality respirators. Asbestos tiles are either face nailed (nailed only at bottom of slates) or blind nailed (at bottom and at the top--beneath the upper slate). Blind nailed tiles are more difficult to remove. Avoid blind nailed until you are more experienced.

For face nailed slates: Place front-end cutters (nippers) directly over nail to be removed and press in carefully but firmly on the slate on either side of the nail head. Grasp the protruding nail head and pull straight out. Do not rock or pry with the cutters. Gently slide slate out from under above slate. You should often be able to do the whole house without breaking any tiles at all. Tack the slate to the building right where it was removed; you don't want to have to assemble a jig saw puzzle when it comes time to replace slates.

For double nailed slates: Repeat above procedure for removing lower nails. Do the same with the course above the one you want to remove. Gently lift up the upper slate so you can get a thin pry bar in under it and be able to catch the upper nails of the lower course of slates. Catch the nail head with the nail puller slot on the pry bay and gently pry up on the nail, using the wood sheathing as a fulcrum. Avoid putting pressure on the lower slate. Pull the prybar and the nail outward and downward to remove the nail.

Once siding is removed, holes can be drilled in the sheathing and the walls filled with insulation. After filling walls, cover the hole with scrap of fiberglass and felt paper before replacing slates. When replacing the slate, nail only along lower edge, using the original holes. A longer nail might prove more secure. Do not home in nail tightly.

Replace broken slates with salvaged tiles from other buildings or use tempered hardboard, precut to size and primed on all sides. Remove slates from rear of house to replace broken ones in the front. Replace the slates from the rear with the new ones (which probably won't match exactly).

Cracked slates can be mended with a thin bead of urethane caulk applied to the back of the slate. The hairline crack won't be noticeable.

If you must cut a slate, place it on a large sheet of plastic on a firm surface (piece of plywood). Dampen the slate with soapy water. Deeply scribe your cut line on both sides of the slate with a hook knife cutter (like used to cut plexiglass). Place cut line directly on edge of plywood, and press down with an even pressure. Wipe off all slurry with a damp rag and dispose of properly with the plastic and all residues.

Never grind the slates or cut with a circular saw. To notch a slate groove the edge with a pair of pliers. If you must drill a slate, dampen the surface with water and drill at a slow speed.

If you cut a lot of slates, consider purchasing a large guillotine slate cutter.

If it is not double-nailed, slate can be the easiest siding to remove and replace, if you treat it with care. Sheets are generally 2' wide and allow for targeted removal.

Remember that this siding may contain asbestos. Although legally you do not have to use special asbestos removal procedures for this application care must be used as not to distribute dust.

### **Tools needed**

End nipper with head ground flat, to eliminate recessed "bite"

Long hacksaw blade or metal-cutting sawzall blade

Flat bar

Side nippers, with flat side ground, to eliminate recessed "bite"

Slate siding is usually installed over lap siding, so it tends to float out from the wall surface just enough so that you can gently push it in and get the end nipper behind the head of the nail. Once done, pull the nail directly out from the wall; **do not pry or pivot** the head of the nipper onto the siding- it will crack! An alternative approach is to cut the nail head off, (it is usually aluminum) and remove the shank after the siding has been removed. The installer does this while he is waiting for the cavity to fill, to speed production.

If there is absolutely no room to get behind the nail I have resorted to digging into the slate with a corner of the nippers, to gain some room to nip and pull it out. This does not look good, but is the only solution. I do not advocate using a small diameter grinding-wheel to remove the nail heads.

Double-nailed slate is much more difficult. It requires the removal of 2 rows of nails; on the piece being removed, and on the piece above it. Once that is done, the lower piece is gently rocked back and forth, to loosen the blind nails. Use the side nippers to cut the nail. This blind nail is usually steel, and will be harder to cut. Do not remove this shank, since you can re-hang the piece you just removed on it. If cutting is too difficult, or there is not enough room, use the blade to saw it off.

### **STUCCO**

Break a 2-1/4" hole through the stucco with a rock pick, air chisel, or rotary hammer.

Pry open wire lath with a pair of pliers or sidecutters.

Patch with 1) tarpaper. 2) expanded metal lath. 3) two coats of stucco (1/3 white Portland cement 2/3 silica sand, lime, stone color and a bonder).

Match texture.

### **MASONITE LAP SIDING**

Do not attempt to pry it off. Just drive the nail head through with a punch. Spackle the old nail holes when you replace the siding.

## **CELLULOSIC FIBERBOARD, TILES, FAKE BRICK AND SHEET SIDING**

Follow general guidelines for wood siding above, recognizing that these materials are much more fragile and you are likely to have tear outs and breakage. Be as gentle as you can. Sinking nails is usually the safest method. Use large nail set to drive all exposed nail heads through siding. Use color-matching caulk as adhesive/binder, sealer in replacing broken sections. Reinstall with large-head roofing nails through undamaged sections. Cover nails with lap of adjoining sections where possible. Hide all exposed nail heads with color-matching caulk. Consider replacing destroyed sections with pieces of similar material taken from outbuildings, enclosed porches or other hidden areas.

## **ASPHALT SHINGLES**

Similar concerns to the section above on cellulosic boards. Remove nails from three runs and remove the shingles like siding. Fold the tarpaper back and drill through the sheathing. Asphalt shingles may become particularly fragile in both extreme cold and hot weather. Popping nails through the material or cutting seams with a sheetrock knife may be your best bet.

Marred surfaces and nail holes and heads can be hidden with a thin film of caulk covered with color-matching granules taken from similar roof and wall shingles.

## **VERTICAL SIDING, 4X8 PLYWOOD, OR MASONITE SHEETS, BRICK VENEER, ETC.**

All should be done from the inside. It is not recommended that you insulate between withes of structural brick; moisture/freezing damage to the exposed brick surface may result.

For face brick, the goal is to insulate the frame wall, not the narrow space between the wall and the brick. The easiest way to gain access here is to drill from the interior of the house.

## **BUILT UP ROOFING**

If you cannot patch it, do not touch it. Hire a roofer to open and close for you or do it from inside. Holes can be covered with roof vents but at least three layers overlapping roofing material thoroughly saturated with roofing cement must be carefully applied.

## **DRILLING INTERIOR WALLS**

It's important to know how to drill from the inside. This is the fastest method if the house is empty and is used as a backup for other methods in trouble spots:

Have the homeowner clear all outside walls four feet back. Prepare the clients for intrusion and dust. They will also be responsible for the light sanding and painting of patches.

Take special care to control your dust. Some agencies have used a Shop Vac vacuum- dust collection system associated with their drill.

Perform a lead test on any painted surface to be drilled- do not drill if positive for lead without lead safe practices in place.

Be aware that in rare cases older plaster or gypsum lath contains asbestos. Identify these conditions before drilling and look to an alternate strategy. In Milwaukee, WI we have received reports of asbestos in up to 20% of older joint compound and 5% of older plaster. Call for sampling before deciding on a strategy and price and make sure it's safe before work begins.

High quality dust masks are always recommended. Entire interior of the house must be masked with 2 mil. poly or equal. This sounds harder than it is. Extra care should be taken to protect electrical equipment as stereos, VCR's, and home computers.

Drill 2" holes in the plaster with a carbide tipped hole saw. Do not cut into the same lath across two stud cavities - a crack will develop.

In some cases, especially with balloon frame walls, access can be gained by removing baseboard, chair rail, or ceiling cove moldings and drilling behind, later replacing the trim. This does not negate the need to thoroughly seal the holes for air and moisture intrusion, but the plaster job need not be done to high aesthetic standards.

Holes in the back of closets are more acceptable than open walls. Holes lower on the wall which will be hidden by furniture are less noticeable than high on the wall.

Fill the cavities as normal. Unless probing proves it unnecessary, the exterior run of the partition walls should also be filled as a bypass preventer.

For cavities too narrow to tube fill, e.g. back plaster, drill two 1-1/4" holes per cavity and use the old timer's two-hole procedure with a trickle feed starting with air first in each hole.

Patch the base coat as soon as the drill person is free. Mix Structolite and Durabond 45 half and half, stiff enough not to sag. Never put on too much. Use Durabond 90 when greater strength or more than 1 hour of working time is required. Leave the first coat indented. Second coat can be straight Durabond. Topcoat with joint compound or spackle, cutting off the excess with the edge of the knife drawn sharply across the patch.

Roll up poly and clean up residual dust. Hepa vac is recommended.

## **OTHER ACCESS**

In some cases, access into sidewalls, partitions, floor joist cavities and roof slopes can be most easily gained from either the top or bottom from attics, basements, crawl spaces, kneewalls, service stairwells, porch and addition attics. When blowing upwards from basements, kneewalls etc., fiberglass batts stuffed into the stud/rafter cavity will act as a filter and block for the blown insulation. Be sure your insulation tube extends the total distance you wish to insulate. Probe all cavities to be sure--unless you have an infrared thermographic camera on site to verify that you guessed right.

## **REINSULATION**

Reinsulating cavities already filled with dense-pack cellulose insulation may be called for if a house exhibits the following signs-

High CFM readings after all attic, foundation, and window/door air-sealing work is done  
IR scan with blower door indicates voids in wall insulation or unexpected leakage locations  
High fuel consumption, home-dweller discomfort-(the house is "insulated", but not working or performing as it should).

A lot of end-wall and slant-wall blowing will consist of re-packing existing insulation, which is not as straightforward as open cavity blowing. The new cellulose being blown doesn't necessarily fill the voids completely with just one pass. When coming across situations where this seems likely, Set the fill lower to maintain flow, and run the tube along each side of the stud or rafter, so that each cavity gets two fills, each one needing to pack an 8" wide space. This assures better coverage. Also, to get

the hose down a pre-blown cavity I will run the air only- this blast of strong air moves insulation out of the way for the tube to probe to the bottom of the space being blown.

Reinsulating enclosed walls, slants, and cathedral ceilings with existing full batt or blanket insulation poses unique problems and is generally not recommended. The additional benefit of cellulose in an already full cavity is generally too small to justify the cost and risk. Don't densepack complete cathedral ceilings in the north without continuous mechanical ventilation in place and control of wintertime humidity to below 35% is assured. We don't know all that we need to know at this time. Climate chamber tests at 50% interior RH in Montreal, Quebec showed saturation of the roof framing and deck over wall tops and bypasses in the first season that did not dry out. Condensation can buildup on cold surfaces inside hidden cavities with high interior humidity. With cellulose there is always some air movement. Even slow airflow deposits too much moisture. Stop airleakage at wall tops instead. Seal all openings into vaulted ceilings insulated with fiberglass or add foam over the roof sheathing instead. Tongue and groove paneling with fiberglass needs detailed airsealing at joints plus humidity control. Better with sealed sheetrock behind the paneling, blown cellulose alone is not enough when the humidity is high. Perfect air tightness is never achieved. The existence of some fiberglass maintains increased hidden airflow. Some jobs with complex, impractical airleakage sites, or lots of attic ductwork benefit from rethinking the location of the thermal envelope. A cathedral ceiling treatment works well from inside with 2-1/2" of 2-part foam against the roof sheathing and 1" of spray cellulose as a fire coating for R-22 total. This approach brings the attic inside, meets vapor retarder requirements and allows some drying with a perm rating of about 1. See commercial roof details for other proven alternates. Densepack of complete cathedral ceilings in the west and south is less risky due to reduced wetting and increased drying to the inside but is still contentious. Very high humidity areas like Houston, Texas have shown water accumulation in roof deck materials over blown cathedral ceilings. See Joe Lstiburek, Building Science Corporation about this issue. Control of humidity is required in all cases since drying is reduced in the packed cavity.

Don't attempt to repack through fiberglass in walls and slants unless the cavity is only part done and allows tube access or there is some unusual problem with airflow like mold or ice on the interior. Fiberglass batts move air but catch blown insulation and only allow lateral movement of a few inches. Batt placement is often non-uniform in cavities. Work the tube in a back and forth motion, from side to side within the cavity to catch the full width of the cavity or don't do. Half-thick batts, such as the tar-paper balsa wool batts from the fifties and sixties can be successfully blown, but you have to get the hose into the empty half of the cavity, preferably the interior. Once there, the tube can slide up the wall fairly easily and do a good job of filling the cavity. Partial flat roofs and slants that are open to vented attics above and below have been blown in thousands of homes without problems as long as primary airleakage is limited and humidity is controlled.

Walls previously blown with cellulose and rock wool are frequently re-blown because the insulation has settled due to improper technique, voids and low density. Cellulose in smooth cavities has been tested to settle at densities below 4# per cubic foot. Typically the top of the cavity and the framing details are in need of additional material. The 2-hole method of blowing often leaves the area between the 2 holes less dense-an important fact when you go to re-blow. The usual pattern is to drill a hole 2' from the bottom and 2' from the top of each 8' wall cavity. If you start to re-blow walls at this same 2' level, you may find the insulation to be quite compact- due to original fill and effects of settling. One has to push the hose well past this lower section and get into the very upper and middle zone to achieve any results. Unless there is a void or framing connection the low density in this area

between the holes presents no real problem and reblowing it provides no real benefit. However, on balloon framed houses the band joist area will be particularly important to address due to the open framing connection.

Another consideration with reblowing is to be sure there is not a large amount of cellulose accumulating in the hose at the end of a cavity, causing plugging due to an overly feed-rich mix. Most contractors are using machines with airlock chambers (Force 2, Krendl 1000). Even with the slide gate narrowly opened for walls, if the feeder is allowed to run without moving material, the chambers will fill with cellulose. When this mass of material moves further through the hose, this large mass will either plug at the narrowest opening, or flow into the wall cavity at such a fast pace it cannot properly disperse. Many crews give up on reblowing because they “can’t get anything into the walls”. It is a matter of understanding the dynamics involved, and tailoring technique to suit the conditions. It is important that the agitator or feeder is switched and the air blower is able to run independently. Machines intended for spray applications are wired the other way to keep the agitator or feeder on and switch of the air – this wiring setup needs to be reversed for cavity insulation. Turn off the feeder and finish the cavity with air only since there is already enough material in the hose. Overall costs are not reduced when reblowing cavities with existing insulation since the practice often requires more time than blowing empty cavities.

Other less common materials placed in walls include woven flax blankets, building and tar paper, “back-plastered” lath and plaster barrier, and loose paper, etc. Each adds cost and provides significant challenges to successful job, but in most cases can be overcome. Finding these obstacles before work begins is important in determining cost/benefit.

## **WALL CAVITY TAR PAPER and BACK PLASTER**

Tarpaper, “multicell” newspaper and other sheet materials are fastened into the stud cavity by lath strips, often 1-1/2” inches as original insulation. If the tarpaper is weak enough, the pressure of the air will split it, but this is a random solution and generally happens only after a significant amount of insulation is in place. The edges may get under-insulated if the tarpaper is heavy. Do the interior cavity first, since the force of the installed insulation will bow the paper and reduce the other cavity depth. A smaller tube may be needed. Don’t crank up the pressure and crack the wall trying to pop the paper. Multicell newspaper is best done on the interior side, blowing between the pages can be a bother.

There will be no way to remove or split the material with back-plastered walls and flax-blanketed walls. Prioritize the interior cavity and use a 1” tube. The majority of cases will perform properly since the maximum insulation gets installed and the interior cavity is the primary path for indirect air leakage. In some cases it may be impossible to tube these walls if the plaster is exactly mid-cavity. Three holes per floor may have to be drilled and blown with the reducer method, or foam insulation like Icynene installed instead of cellulose. Targeted use of cellulose or 2-part foam at major wall and framing bypasses is a backup for the airsealing part of the project.

## **START-UP AND ON-THE JOB EFFICIENCY**

At the onset of a job, it is important to get started blowing A.S.A.P. The limiting factor in completing a job is the time it takes to fill all wall cavities, so any time the machine is not running means more time on the job. All initial efforts are to set up the machine, remove the first row, and start filling. It is vital to check all interior surface immediately;

Each crew will find its own rhythm, but I like the “drill and fill” for one worker, and run and remove for the other. There is enough time from the moment you first put a tube into an empty cavity until it fills that one or two holes can be drilled ahead of time. The other crew person fills the machine, removes siding, drills as needed, and replaces siding. It should be a game to see if you can blow continuously without shutting down the machine.

If attic insulation is part of your work order, start there, by blowing all possible open wall cavities in the attic. Balloons framed houses sometimes offer huge opportunities for access to walls from the attic, and are especially helpful above second story windows. The most common example is open stud cavities on gable-ends. If you blow the wall without checking or blowing these first, huge amounts of insulation can be blown up into the attic, since there is no top plate to stop flow, wasting time and materials. I have seen attics with multiple piles of cellulose 3’ deep above wall cavities. If these open end-walls are blocked with lath, use a Sawzall blade to cut an opening for the hose and blow down from the attic. Do not hammer them off, as they are too springy and can ruin the plaster on the ceiling. Don’t drill through the top plate unless siding removal or interior blowing is more difficult.

At this point it is good to include the blowing of slant-walls and floored attic cavities, since these areas also get dense-packed. Slants are essentially sidewalls at an angle, and function very much the same. (Cathedral ceilings can be included in here, with some provisions which will be discussed later.)

A plastic insulation bag stuffed with fiberglass makes a good barrier to place over open cavities, since there will be lots of potential blow-back of insulation. Move it from hole to hole, or have two so one can be stuffed over the next hole, which helps save time.

## **SAFETY REMINDERS !**

Drilling can be dangerous. Always brace yourself securely because you will take a hit if the bit suddenly stops. The larger the bit, the greater the speed and torque of the drill, the greater the risk of smashing your arm into the wall or sending yourself air-borne.

Take care not to plunge blindly with the drill bit; don't drill into outlet boxes or wiring. Note their location before you start.

Use non-conducting ladders, first quality extension cords and ground fault interrupter (GFI) protection. Avoid electric wires either overhead or in the wall. Don't drill in the rain.

Be smart and safe about getting adequate power to the blower and drills. Many programs hook carefully into the home's electric power supply at a 220 v.a.c. dryer or stove outlet or the main box, or use a gas generator or a self-contained truck-mounted blower to provide independent power.

Use your personal protective gear--especially safety glasses and dust mask or respirator.

Attachment A Core Sample chart

Gram Weight per sample taken in wall with 2.25” core sampling tool

Recommend using small poly bag, get tare weight empty, add 3+ samples in a wall and weigh on gram scale subtracting tare weight. The following weights are per individual sample after subtracting tare weight.

depth	@3#/cu ft	@3.5#/cu ft	@4#/cu ft	@4.5#/cu ft
3.5”	10.94g	12.77g	14.59g	16.42g
3.75”		13.68g	15.63g	
4”	12.50g	14.59g	16.67g	18.76g
5.5”		20.06g	22.93g	
7.25”		26.45g	30.23g	
9.25”		33.75g	38.57g	

Area x depth = volume

Sample weight/volume = density

1 cubic foot is 1728 cubic inches

1 pound equals 453 grams

3#/cu ft is 1359grams/cu ft                    0.786458333...grams/cu. in.

3.5#/cu ft is 1585.5 grams/cu ft            0.9175347222... grams/cu in

4#/cu ft is 1812 grams/cu ft                1.0486111...grams/cu. inch

4.5#/cu ft is 2038.5grams/cu ft            1.1796875 grams/cu. in.

Example below is assuming a 2.25” diameter core sampler, thin wall with a sharp edge.

1.125” radius

3.976 square inches area

3.5” depth x 3.976 square inches = 13.916 cubic inches per sample

3.75” depth x 3.976 square inches = 14.91 cu. in.

4” depth x 3.976 sq. in. = 15.90 cu. in.

5.5”depth x 3.976 sq in = 21.868 cu. in.

7.25” depth x 3.976 sq in = 28.826 cu. in.

9.25” depth x 3.976 sq in = 36.778 cu. in.